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NEW PESTICIDES—CAUTIONS AND INFORMATION[1]

M. C. VAN HORN
Florida Agricultural Supply Company

Historians tell us that there is evidence to indicate that the struggle of man to subdue pests began long before civilization was recorded and will, no doubt, continue as long as man exists. It is doubtful if either will ever be able to claim a final victory.

Many pests are very versatile, being able to adjust themselves to changing conditions in seemingly impossible fashion. They are found in the air, in the soil and in the sea. There are few objects, dead or living, which are not, either directly or indirectly, affected by pests of some kind at some, or during all, stages of their existence.

The tangible results of pest ravages take on varied aspects including disease transmission to plants and animals, plant and plant product destruction to say nothing of the staggering losses as would be measured in terms of monetary values. It has been estimated that the losses due to cotton pests alone exceed $250,000,000 each year. Accurate figures as to losses due to pest damage are not known to me. It is reported that in one state in the United States the total value of farm receipts from agricultural crops for one year was approximately $191,000,000. Of the above there were eight major farm crops with an estimated value of $75,000,000, which were almost entirely dependent upon pest control for economic commercial production. An additional $18,000,000 worth required nearly complete protection, making a total of approximately 49% of the crop value of that state dependent upon pest control measures. The balance, or 51%, required periodic or partial protection to some degree. These few and sketchy figures should serve to indicate the staggering world wide loss which may be sustained each year from pests. There is a need for the economic evaluation of pest damage annually by each state in the United States to crops, public health, structures, commercial products, etc.

The problem of pest control is not a local one, or even a national problem, but is a world-wide problem. In order to cope with the situation, man has developed an undetermined number of chemicals to combat these pests, and this number is increasing almost daily. These chemicals, including the insecticides,

[1] A talk presented at the Annual Agricultural Extension Conference, College of Agriculture, University of Florida, October 20, 1949.

fungicides, herbicides and rodenticides, have all been grouped under a recently coined word "pesticides."

This is the subject which I wish to discuss with you. It is a large assignment and one which, if covered properly, would require far more time than allotted to me here, and more, I am sure, than any of you would care to listen to at one, or even several such sessions.

Of these pesticides the relative importance to an individual of insecticides, fungicides, herbicides or rodenticides, may depend upon the region in which one lives or what business he is in, but they are all important at some time to most people, and although we may not realize it, affect all of us either directly or indirectly.

A few years ago the number of these chemicals was relatively few as compared to the list we have today. I am sure that most of you can well remember that when a farmer or home owner presented a pest control problem to you, you could make an approved recommendation to him to cover almost any situation using one or more of the following: nicotine, pyrethrins, rotenone, oil emulsion, lime sulphur, sulphur, calcium arsenate, lead arsenate, paris green, cryolite, sodium fluoride, borax, copper sulphate, soap, etc.

This is not true today. Many of these so-called old pesticides are being replaced by the new organic chemicals. This new wave of organic chemical development started early in World War II and the end does not appear to be in sight at this time, since each day seems to reveal new, more powerful, and amazing tools to the farmer and person interested in pest control.

One of the first of these new chemicals is the well known DDT, chemically dichloro diphenyl trichloroethane. DDT was first synthesized about 75 years ago by a German chemist and was first patented as a pesticide in this country about 1939. Since then, chemically similar compounds such as DDD (dichloro diphenyl dichloroethane) and methoxychlor (dimethoxy diphenyl trichloroethane) have been introduced.

The uses of DDT are fairly well known today. It is interesting to note that resistant strains have developed in certain pests, specifically in flies and mosquitoes. DDD has been found to be useful on certain vegetables (i.e., tomatoes) and on certain fruit crops. Methoxychlor has been found to be very useful on certain DDT sensitive plants and on animals (i.e., cats).

The first phosphate compound was hexaethyl-tetraphosphate (HETP) known as Bladan in Germany. This was a mixture of

two or more phosphate compounds. Later, one of these tetra-ethyl-pyrophosphate (TEPP), was isolated and it is said to be several times more toxic to pests than HETP.

The most recent phosphate development is parathion (diethyl nitrophenyl thiophosphate) which was developed in Germany and first used commercially to any extent in this country in 1948. These phosphate compounds are all highly toxic to warm blooded animals upon contact, inhalation or ingestion. The HETP and TEPP readily hydrolyze upon exposure. Parathion is a more stable compound. They are all good aphicides, and parathion is effective against a rather wide range of sucking and soft bodied pests.

Benzene hexachloride, or BHC, is another relatively new pesticide. This is the chemical characterized by a musty odor. Of the five isomers which have been identified, the gamma isomer appears to have the most insecticidal value.

Quite recently scientists have been able to isolate this gamma isomer in essentially pure form. This chemical is now known as Lindane. Lindane is practically odorless.

One of the major uses of BHC is on cotton, usually in combination with DDT and sulphur. Lindane is an excellent insecticide for use on certain crops such as cucumbers and is also used against DDT resistant flies.

Chlordane, one of the chlorinated hydrocarbons, also known as 1068, is a relatively new organic insecticide used against roaches, mole crickets, grasshoppers and a number of truck crop and animal pests.

More recently new chlorinated hydrocarbons such as Aldrin and Dieldrin have been under tests with limited commercial use to date. Very promising results have been reported following the use of these chemicals for certain specific uses.

Toxaphene or chlorinated camphene, was first commercially available about 1947. The use of this new insecticide has expanded rapidly in the cotton pest control program, for use against worms and grasshoppers and against certain animal pests.

Piperonyl butoxide is a new non-hazardous insecticide especially designed for use against flies and certain other pests where non-poisons are required.

Against mites on plants "DN", selocide, and K1875 have been used in varying degrees.

The early fungicides consisted basically of sulphur or copper in some form. Today, these same two materials are still used extensively in one form or another. There appears to have been many more radical changes in the forms and formulations of the coppers than with the sulphurs.

In addition to the above, there are a number of new fungicides including the carbamates, quinoline compounds, chlorinated quinones, chlorophenates, various organic mercury compounds, and various chromate compounds.

One of the difficult problems connected with referring to these new chemicals other than by brand name, is the long "tongue-twisting" and little understood and difficult to remember chemical names.

Some progress has been made to remedy this situation by adopting coined words which may be used in lieu of the chemical name when referring to the active content. Typical examples of these in the insecticide field are: chlorinated camphene may be referred to as Toxaphene. The essentially pure gamma isomer of BHC may be referred to as Lindane.

Very recently, it has been reported that the Sub-Committee on Fungicide Nomenclature of the American Phytopathological Society and their associates, have adopted the following coined words as they refer to certain of the new organic fungicides:

Ferbam—ferric dimethyl dithiocarbamate
Ziram—zinc dimethyl dithiocarbamate
Nabam—disodium ethylene bisdithiocarbamate
Zineb—zinc ethylene bisdithiocarbamate
Thiram—tetramethylthiuram disulfide

One of the largest single increases in the pesticide business which has occurred in recent years has been the herbicide field. This is especially true in the corn, grain, flax, and rice belt. There appears also to be a large field still to be developed in the open range pasture of the great plains, against brush and, possibly, in other areas.

The major chemical used for this purpose has been 2,4-D in some form, or a similar compound such as 2,4,5-T. There have been millions of pounds of 2,4-D weed killers used this past year. The results obtained are reported as generally satisfactory, although if improperly used, these weed killers can be very damaging to commercial crops. Certain of them are volatile and the fumes can be injurious to nearby economic plants.

Other weed killers for specific uses include the dinitrophenol compounds designed for burning back potato tops and pre-emergent weed control. Other weed killers include the acetate compounds, sulfomate, and such non-selective materials as the arsenicals, the chlorates, the borates, oil, etc. The herbicide field is still in its infancy and there are many opportunities in this field to be developed.

A number of new rodenticides have been introduced. No attempt will be made to list them.

With the very rapid development of these new chemicals, it is very difficult for anyone to keep abreast of them, and especially the person who works with them only occasionally.

For maximum results and proper safety it is suggested that those responsible for supervision of pest control familiarize themselves with the use of the pesticides concerned. This usually can be done by either reading the literature on the product or the label or both.

A properly labeled product should provide directions for use, give an analysis of the product, cautions, antidotes, where necessary, and other pertinent data pertaining to the product. These instructions should be understood and followed by the applicator.

Most of these new organic insecticides are available in the form of dusts, wettable powders, emulsive liquids, with some in bait and others in aerosol forms.

Normal precautions of handling economic poisons are usually adequate for DDT, Methoxychlor, BHC, Lindane, Toxaphene, Chlordane, etc., however, certain of these materials, particularly the phosphate insecticides and specifically parathion, should receive special attention and should be handled with great care. The person charging the machine and the applicator should wear effective toxic respirators. They should wear protective clothing and natural rubber gloves so that the skin will not come in contact with the material. Neither the fumes, the dilute dust, or spray mist should be inhaled. They should wash their hands and face before either smoking or eating. Clean and uncontaminated clothing should be provided for each shift. If exposed, the skin surface should be washed at once. At the first sign of headache, nausea, tightening of the chest, or constriction of the pupils of the eyes, consult a physician at once. The indicated treatment is atropine, followed by oxygen as directed by a physician.

A number of authorities have stated that if proper precautions are followed these good pesticides can be used safely.

Some suggestions as to the use of pesticides, especially the new ones are:

1—Handle and use pesticides safely. Store away from food and feed.
2—Read, understand and follow label data and other directions for use.
3—Know pest to be controlled and use measure recommended to control it.
4—Do not overdose.
5—Apply pesticide in manner and time recommended.

The National Agricultural Chemicals Association, Barr Building, Washington, D. C., recently published an 8½ x 11 sheet entitled, "How to Choose and Use Pesticides Properly." It lists ten concise clear points. If you do not have a copy of this and would like one, they may be obtained upon request.

An interesting article appeared in the April 1949 issue of the *Farm Journal* entitled "How Dangerous are the New Bug Killers?"

I am confident you are all familiar with and probably have a copy of the "Handbook on Pesticides and their Uses in Florida Agriculture" as published by the Florida Agricultural Experiment Station, Gainesville, Florida, February 1, 1949.

There are also other somewhat similar new releases available, including:

"Insect and Plant Disease Handbook," published by Clemson Agricultural College, Extension Service, Clemson, S. C., November, 1948.

"Fungicide Information," published by the University of Maryland Extension Service, College Park, Md., December, 1948.

"Pest Control Materials 1949," published jointly by the Pennsylvania Agricultural Experiment Station and the Maine Agricultural Experiment Station, dated January, 1949.

"Agricultural Insect and Disease Control Recommendations," compiled by Curtis Publishing Company, Philadelphia, Pa., 1948.

There are probably other such works and no attempt has been made to list them all.

I am sure that we are all aware that many of these pesticides, if taken in sufficient quantities, are poisonous to warm-blooded animals.

We all recognize that their use is essential to protect health and produce the amount and quality of products the entire world needs today.

I believe we can also agree that if these pesticides, which are so valuable and essential to us and our well being, are correctly used they are harmless to those who apply them and also to those who consume the products protected.

It is my belief that this goal can best be attained through education, a field to which the Extension Service is dedicated. To this end we pledge to you our complete support.

THE BEHAVIOR OF PURPLE SCALE POPULATIONS ON CITRUS TREES IN FLORIDA *

J. T. GRIFFITHS, JR. and W. L. THOMPSON
Florida Citrus Experiment Station, Lake Alfred

During the past 50 years in Florida, purple scale, *Lepidosaphes beckii* (Newm.), has been the primary scale problem on citrus trees in Florida. The amount of damage due to this pest has varied from year to year and from decade to decade, but, in a general sort of way, the first half of the 20th Century may be divided into the three periods as defined by distinct differences in the problems which have been encountered with this insect. Prior to 1925 scale infestations were fairly common, and some control measures were undertaken. However, regular spray programs for scale control were not applied, because satisfactory means did not exist. From 1925 to 1935, definite changes took place in citrus groves in Florida. Plantings were shifted to the sand hills of central Florida, and there was a change from organic to inorganic fertilizers. As a result of improper feeding, magnesium, manganese, copper and zinc deficiencies developed. In the early 1930's, trees grown in the sandy soils were in very poor growing condition, deficiency symptoms were common, and scale populations were at a very low ebb. Although oil emulsion sprays were available during this period, very few sprays were applied for scale control. Beginning in 1936, new fertilizer practices were instituted. These involved the use of magnesium, manganese and copper in the fertilizer, and the use of copper, zinc and manganese sprays, with copper and zinc sprays being applied regularly. The change in fertilization practice resulted in increased yields and improvement in the general size and the vitality of the

* Presented before the 1949 annual meeting of the Entomological Society of America.

trees. Accompanying this, there was a marked change in the insect picture on citrus trees in Florida. Zinc and copper sprays were partially responsible for increased insect injury, but the increased shade and tree vigor seemed to offer better living conditions for both insects and mites. Where it had previously been unecessary to control scale, scale insects now became a major problem for the citrus grower. Today, scale insects represent the primary source of tree damage in the state of Florida. Purple scales are distributed throughout the citrus area and are a major problem wherever they occur.

At the present time, in the state of Florida, another change in the general production picture appears to be taking place. In the 1949-50 season more than 50 percent of the citrus crop will be canned as single strength juice or as frozen concentrate, This means that the external quality of much of the fruit need not meet the fresh fruit standards as in the past, and this subsequently means a change in general spray programs and spray practices. An effort is being made to evolve a spray program for canning plant fruit which will necessitate a minimum of spray applications, but which at the same time will maintain yields and internal fruit quality as high as they have been previously. Reductions in the amounts of copper and zinc to be used as sprays can probably be made. The use of copper for the control of melanose (a fungus disease which affects external quality) will probably be almost eliminated on fruit which is to be canned. Since zinc has been used for more than 10 years, citrus groves are generally free from zinc definciency. Therefore, it is possible that trees can be maintained with soil applications, or at least maintained without an annual zinc spray. Lower mite and scale populations should follow a reduction in the amounts of zinc and copper. This fact has been substantiated most recently by Griffiths and Fisher (1, 2).

For the past three years rather careful records have been kept of scale infestations in a number of citrus groves. More complete records have been kept during the past two years, and most of the following discussion will be centered about the 1948 and 1949 seasons.

It is the purpose of this paper to demonstrate the behavior of scale insect populations on citrus trees in Florida as observed where some different spray programs were in effect. A complete spray program includes the use of compounds of copper, zinc, sulfur, DN (40% dinitro-o-cyclohexyl phenol) and oil emul-

sions. Scale population behavior under such a program is compared with that where certain or all of the materials have been eliminated from the spray program.

BEHAVIOR OF SCALES IN UNSPRAYED GROVES

Figures 1 and 2 present data from September 1947 through November 1949, for four groves in or near Lake County and for three plots located on the Citrus Experiment Station grounds in Polk County. The two sets of data are separated because general behavior patterns appear to have been somewhat different in these two areas. In general, Lake County will experience slightly colder weather during the winter than Polk County, and it is possible that this may explain some of the differences.

In these and subsequent graphs, some irregularities occur. These are often present during the spring of the year and may be accounted for by inaccuracy in sampling methods. Scale counts were made by a method previously described by the authors (3). This involves taking 50 leaves per tree and examin-

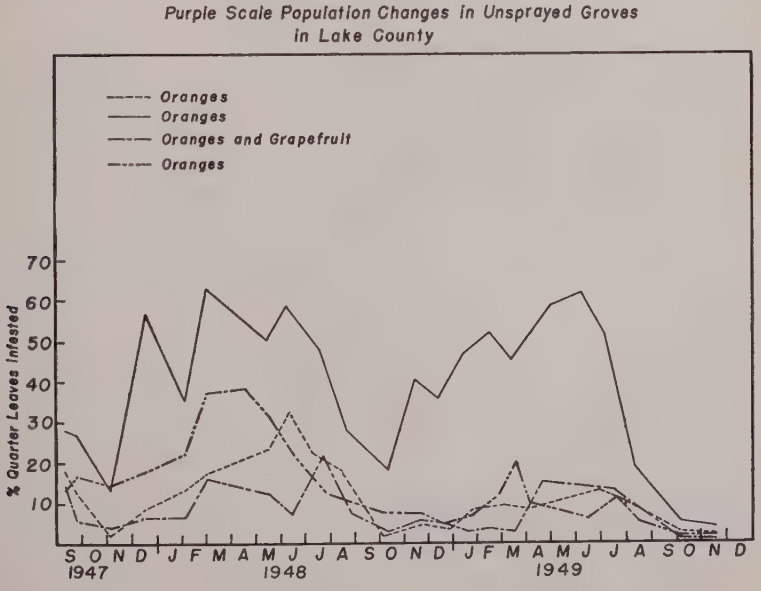

Figure 1

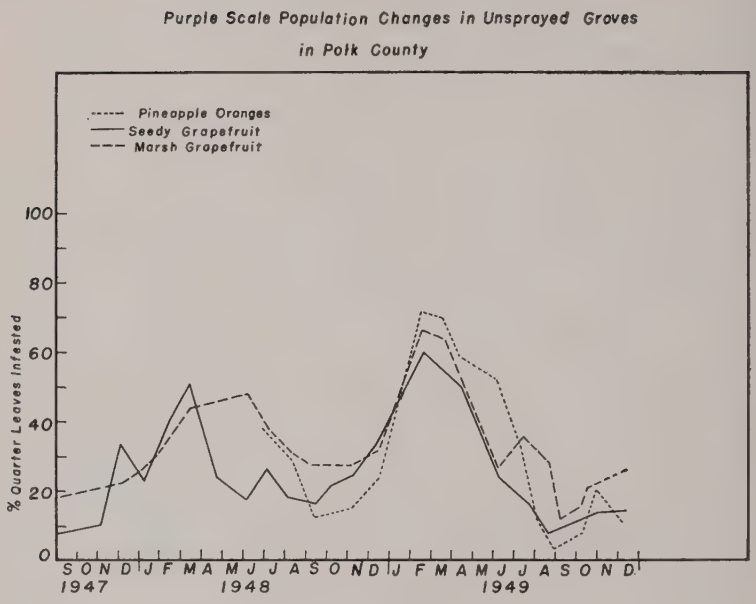

Figure 2

ing them for living scales. In the spring, the major leaf flush occurs just prior to bloom. Usually, this period coincides with a time of maximum egg deposition by the infesting scale insects and scale crawlers tend to migrate to new foliage. Thus, there is a general exodus to new growth. Sampling is complicated by this shift in population, and counts made during this time are apt to present a slightly inaccurate picture of the infestation. The total scales per tree may have increased considerably, but the percentage of leaves infested may appear to have decreased if new foliage has been picked.

In Figs. 1 and 2 it will be noticed that, for three years, during the period from August through November, scale populations attained a minimum. They regularly decreased during the summer, but by late fall were again increasing. In this connection, it should be noted that prior to the introduction of present day spray schedules, oil sprays were often applied as fall clean-up sprays. Growers of citrus for many years often comment upon the effectiveness of such sprays for scale control. The fact that they were spraying populations at the lowest

density during the entire year was undoubtedly an important factor in the excellent scale control which often resulted.

The amount of increase in the fall and the rate of increase throughout the winter months is probably a factor related to winter temperatures. During the fall and winter of 1946-47, 1947-48, and 1948-49 temperatures were generally high throughout the entire period. This resulted in scale increases throughout the winter months. The past three years have been exceptional, in that purple scale populations have been high, and excessive damage has resulted in many groves. The application of two oil sprays for scale control has been necessitated in many individual holdings. It will be noted in the graph on groves in Lake County that higher scale populations were generally attained during the 1948 season than in 1949. The opposite is true of the groves shown from Polk County. The Lake County groves probably reflect a truer picture of the situation throughout the state. In general, scale populations have been much lower during the summer of 1949 than during the preceding two years. It will be noted that, in the Polk County groves, maximums were reached in February and March of 1949, and that populations continued to decrease from that time on. This represents an abnormal situation when compared to the past. In general, scale populations in unsprayed groves reach their minimum in the fall of the year, either stabilize or increase slightly throughout the winter months, and finally attain a maximum during June and July of the following summer. Decreases caused by natural control agencies become evident in July, August, or September and minimums are again reached during the fall of the year. The 1949 season seems to offer an enigma as far as decreases throughout the spring and summer are concerned. These decreases were experienced throughout the entire citrus belt, in spite of the fact that weather was dry in the spring and was not what would normally be considered advantageous for the functioning of scale fungi. In fact, dry weather has always been considered to be a major factor in scale population increases, and the 1949 season was in direct opposition to this presupposed thesis.

It will be noted that one of the four Lake County groves shown has consistently had higher populations than the other three. This was true also in the 1946-47 season. All four groves are treated with occasional sulfur dusts for the control of the citrus rust mite, but copper, zinc, and oil emulsion sprays

are not used. In Fig. 1 the three groves with lower scale infestation also have populations of the tree snail, *Drymaeus dormani*. The claim has been made by many growers that the presence of these snails will result in reduced scale populations. The authors have never been able to substantiate this on the basis of good data. Tendencies are certainly evident here, but it should also be noted that groves which are satisfactory for growth and reproduction of snails are also groves which tend to have high humidity factors and which are planted in such a fashion that good shade is present throughout the entire year. As opposed to this situation, the grove with the greater scale population (Fig. 1) has smaller trees which are planted far apart, so that the same type of shade and moisture conditions are not present. It would be expected that entomogenous fungi might not function as satisfactorily in the latter grove as in the three groves where snails are present. Another factor must be mentioned, however. When snails are present in large numbers, the trees attain a very slick appearance due to the removal of sooty mold from the foliage and fruit. Where this condition exists almost no residue of any type is present on the foliage. It is to be expected that residue-free leaves would be relatively unsatisfactory for the settling of scale crawlers, since they seem to prefer dirty leaves to extremely clean ones. How much of a factor this is in the reduction of scale populations in these groves cannot be determined at the present time. It should also be noted that the grove listed as having both oranges and grapefruit was almost completely defoliated in February of 1948. Most of the snails had died by November of 1947, and it was not until the late summer and fall of 1949 that high snail populations were again attained in this grove. In spite of this fact, scale populations seem to follow similar trends to those in other snail groves. This would appear to be an argument against the fact that snails are major factors in causing reduced scale populations in citrus groves. In addition to this, the groves which attained the second highest infestations both in 1948 and again in 1949 as shown on Fig. 1 has not been properly fertilized for the past two years. The trees are in a very hard condition, growth flushes have been very much below normal, and such trees are not trees which are satisfactory for the development of maximum scale insect infestations. These factors must be considered in attempting to evaluate the possible value of snails in citrus groves in Florida.

THE BEHAVIOR OF SCALE POPULATIONS IN SPRAYED GROVES

Figure 3 shows the difference in behavior of scale infestations on three separate spray programs from plots at the Citrus Experiment Station in Polk County. One plot represents unsprayed controls where no sprays or dusts of any kind are

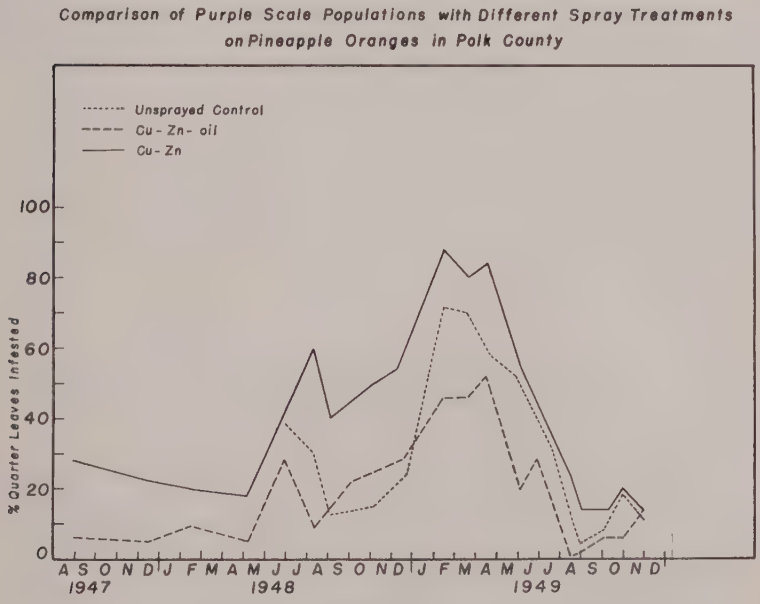
Comparison of Purple Scale Populations with Different Spray Treatments on Pineapple Oranges in Polk County
Unsprayed Control
Cu - Zn - oil
Cu - Zn
% Quarter Leaves Infested
100
80
60
40
20
0
A S O N D J F M A M J J A S O N D J F M A M J J A S O N D
1947
1948
1949

Figure 3

applied; one represents a plot in which copper, zinc and sulfur are used, but where no scalicides are applied; and the third represents a standard spray program as practiced throughout most of the citrus area. This latter program includes the use of copper, zinc, sulfur, and DN (40% dinitro-o-cyclohexyl phenol) as well as an oil spray for scale control. The unsprayed control plot was not started until 1948 and counts were not initiated until the late summer of that year. Certain trends are evident in this graph, and based on general observations throughout the citrus area represent conditions which would be expected to occur under the various spray programs involved. It will be noted that maximum populations are found, of course, on the trees where copper and zinc are used and where no oil spray follows.

The oil sprays in the complete spray program were applied on the first of July and resulted in the decreases in infestation between July and August in both years. The unsprayed control has lower populations than the trees containing copper and zinc sprays. At times, the populations on this program are actually lower than where oil sprays are applied. It will be noted that during the fall of 1948 this situation existed, and according to the last counts made in 1949, this group of trees again has less scale than was found on the other two programs. These data again illustrate the same thing noted in Figs. 1 and 2 in that for most groves, maximum populations in 1949 were attained during the early spring months. Regardless of the program, the scale population decreased throughout the late spring and the summer. This has resulted, during the fall of 1949, in a general condition over the entire state where purple scale populations are at a minimum.

DISCUSSION

Figure 4 is a theoretical situation designed to demonstrate the difference in scale insect populations resulting from several types of spray programs. This is hypothetically drawn from data such as that presented in Fig. 3, and is based upon observations from many groves throughout the entire citrus area. If we assume that three programs are instituted where initial scale infestation is identical, certain things would be expected to occur. On those trees where copper and zinc is included in the spring of the year, greater increases would be experienced than on the unsprayed controls. These increases would continue up until late summer or early fall, in the case of the plot which received copper and zinc. In the case of the unsprayed control, decreases would begin in July or August. A spray applied for scale control in July would reduce the population in those plots to almost zero, but increases would start immediately after the oil spray and would continue throughout the fall, and if weather conditions were satisfactory, on through the winter months. As noted on the graph, groves on the oil, copper, zinc, sulfur program would often have more scale in the spring of the year than would those on no spray program at all. They would have less during the latter part of the summer, but during the fall and winter months the populations might be very similar to those of the unsprayed controls. The trees receiving copper, zinc and sulfur, but no oil would end the season with much

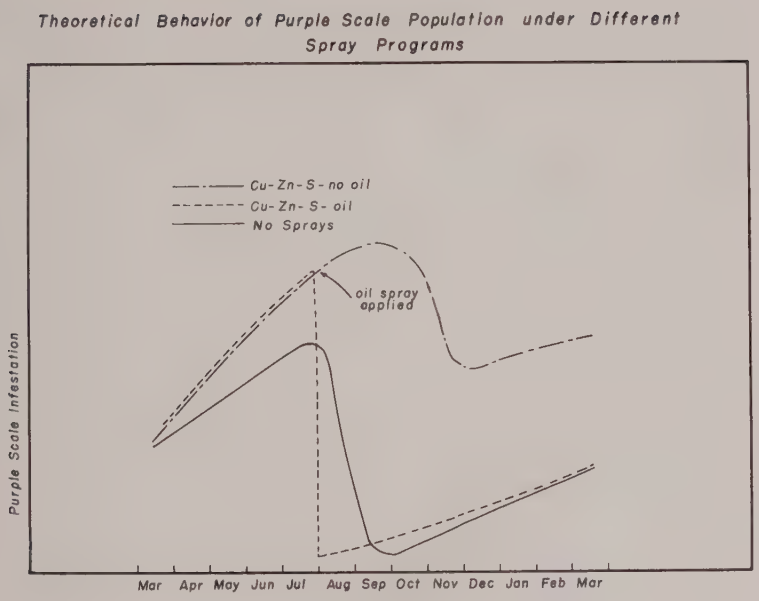
Theoretical Behavior of Purple Scale Population under Different Spray Programs
Cu-Zn-S-no oil
Cu-Zn-S-oil
No Sprays
oil spray applied
Purple Scale Infestation
Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar

Figure 4

higher populations than either of the other two programs. This points up the fact that the addition of copper and zinc in the spray program necessitates sprays for scale control. Thus, if copper and zinc are eliminated from spray programs, it may be possible to also eliminate sprays for scale control in some years, but at the same time maintain maximum yield with minimum tree damage from scale insects.

In support of the thesis that it may be possible to eliminate sprays for scale control in some years if no copper and zinc sprays are used, the following data on dead wood cut from trees is pertinent. In a Pineapple orange block at the Citrus Experiment Station several spray programs are present. One is a complete spray program which includes zinc, copper, sulfur and oil. The oil is applied about July 1; second program is identical, except that no oil is used; and a third set of plots receives no sprays or dusts at all. In March, 1949, dead wood was cut from those trees. An average of 12 pounds were removed from the unsprayed control as compared with 26 pounds on the copper-zinc-sulfur-oil program and 36 pounds on the copper-zinc-sulfur-no oil program. The introduction of parathion as a spray for

scale control on citrus (4) may mean that scale can be controlled without damaging results from oil sprays so that there will probably be less dead wood not only from scale, but also from oil damage. In the parathion sprayed plots (includes copper-zinc-sulfur) in this same series of experiments only 12 pounds of dead wood was removed in 1949. It may be possible that, where groves receive little or no copper and zinc, parathion sprays will further reduce scale populations to such a level that even greater yields might be attained.

SUMMARY AND CONCLUSION

Data are presented to show the behavior of purple scale populations in groves in Florida where only sulfur is used as a spray or dust program. In these groves, maximum infestations are usually attained during the late spring or early summer, and minimum infestations occur during the months of September and October. Data also compare the difference between the trees receiving copper, zinc, sulfur and oil against copper, zinc, sulfur and no oil, and against no sprays or dusts at all. These findings may serve as a basis for attaining short-cut spray programs which will meet requirements of fruit for canning plant operations.

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ON TULLGREN'S FLORIDA SPIDERS[1]

H. K. WALLACE

Through the courtesy of Professors Albert Tullgren and Ake Holm, of Sweden, I have had the opportunity of studying some of the spiders described by Tullgren (1901) from Florida. In the twenty-two vials received from them are included all of the specimens described as new species in the families Lycosidae and Attidae [Salticidae] plus a few other individuals in the same families. The following Lycosids and Salticids recorded by Tullgren (1901) were not included in the twenty-two vials received: *Lycosa carolinensis*, *L. arenicola*, *L. nidicola*, *L. tigrina*, *Pardosa rufa*, *Phidippus mineatus*, *Dendryphantes capitatus*, and *Icius palmarum*.

All of the specimens received are well preserved and in excellent condition, but appear to have become much lighter in color than when collected. In some the chitin has become somewhat transparent so that more detail in the structure of the epigynum is now evident than appears in Tullgren's drawings. Some of the specimens are accompanied by labels bearing a different name than that under which they were described. No types were selected by Prof. Tullgren or labeled as such. In appropriate cases I am selecting lectotypes as Dr. Holm requested. All specimens, including lectotypes and one holotype will be returned to the Zoologiska Institutionen, Uppsala.

In order that other students may reconstruct the situation in this collection of specimens that it has been my good fortune to examine at first hand, I shall list the contents of each vial, give data as it occurs on each label, and redescribe and refigure those specimens that are not clearly recognizable from Tullgren's descriptions.

FAMILY LYCOSIDAE

Lycosa angusta Tullgren

Figure 7

1901. *Lycosa angusta* Tullgren (in part), Bih. Svenska Vet.-Akad. Handl., 27(4, 1): 16; figs. 7a, 7b. [♀ and ♂ described; 2♂♂, 6♀♀ recorded; no type selected.]

1942. *Lycosa timuqua* Wallace (in part), Amer. Mus. Nov., No. 1185: 8; fig. 19. [The central peninsular form.]

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[1] A contribution from the Department of Biology, University of Florida.

LECTOTYPE.—Male from Orlando, Orange County, Florida, collected by E. Lönnberg, 1892-93, labeled *Lycosa pallens* n. sp. Deposited in the Zoologiska Institutionen, Uppsala, Sweden.

DESCRIPTION OF LECTOTYPE.—Carapace amber in color, with radially disposed darker streaks; dorsal stripe faintly indicated; eyes partly surrounded by black areas, eye region provided with numerous long bristles. Dorsum of abdomen light yellow, speckled with tiny dark spots and provided with a sparse covering of erect bristles; these bristles longest in the region of the hastate mark which is only faintly indicated. Sternum and coxae dusky, venter black. Legs unbanded, metatarsus and tarsus I and II darker than the other segments.

Carapace longer than broad (10.5 mm./8.0 mm.), 4.5 mm. high; width of the head opposite the posterior lateral eyes 4.4 mm. Posterior eye quadrangle wider than long (2.7 mm./1.8 mm.), eyes of the median row larger than those of the lateral (1.0 mm./0.7 mm.); median row wider than anterior row (2.2 mm./1.8 mm.). Anterior row of eyes almost straight, eyes equally spaced, medians larger than laterals. Palpal segments: femur 4.1 mm., patella 2.1 mm., tibia 1.8 mm., cymbium 3.7 mm.

	Femur	Patella	Tibia	Meta-tarsus	Tarsus	Total
I	9.1	4.4	7.6	8.3	—	—
II	8.7	4.1	7.0	7.9	4.4	32.1
III	8.0	3.6	5.8	6.8	4.2	28.4
IV	10.0	3.9	7.9	10.9	5.1	37.8

DIAGNOSIS.—This spider cannot be distinguished from *L. lenta* Hentz, *L. ammophila* Wallace, *L. ericeticola* Wallace, and *L. miami* Wallace except by differences in the structure of the male palpus. It is the central peninsular form of *L. timuqua* Wallace (1942), and the male, at present, cannot be distinguished from that species. However, differences in the genitalia of the females makes it possible to distinguish between the two.

DISCUSSION.—The proper disposition of Tullgren's *angusta* poses something of a problem. He described first a large female (carapace 11.8 mm.) and then a large male (carapace 11.0 mm.) and listed two adult males and six adult females collected by Mr. Lönnberg at Oakland and Orlando in Orange County. He figured both palp and epigynum but did not designate a type. Based on this much information, I suggested in 1942 that my central peninsular form of *L. timuqua* might be Tullgren's *angusta*. Due to the fact that Tullgren's figures of palpus and epigynum did not resemble closely anything I had seen in the *lenta* group I was not sure of this identification and, accordingly, also suggested that *L. pseudoceratiola* and *miami* might also be candidates for his name. Size is so variable within this group that I was unwilling to place any importance on this feature alone.

Among the specimens shipped to me from Uppsala are two adult males and six adult females in five vials, all from Oakland or Orlando where locality is given, and all labeled *Lycosa pallens* Tullgren, new species. By a simple process of elimination it is clear that these are the specimens cited by Tullgren as *angusta*. No type is indicated on the labels. The contents of the five vials, the data on the labels, and my determination of species is as follows:

Vial 1.—Label (penciled in longhand—most of this label almost illegible)—**U. U. Z. M. Lycosa pallens, n. sp.** ♂. Label—**Orlando 1892-93 E. Lonnberg.** This is a large male of my *L. timuqua* central peninsular form, and is, I am certain, the specimen described and figured by Tullgren as the male of *L. angusta*. As noted above the figure of the palpus is such that I would hesitate to make a decision on it alone, but the size given in Tullgren's description leaves little doubt as the only other male is a much smaller individual of *L. ammophila* Wallace. I have selected the specimen from this vial as the lectotype because there can be no question as to its identity whereas none of the females could be selected with equal certainty.

Vial 2.—Label (penciled in longhand)—**Lycosa pallens n. sp. A. Tullgren.** Label—**Florida Orange County 1892-93 E. Lonnberg.** This is an adult female possessing an epigynum typical of the central peninsular form of *L. timuqua* = *L. angusta*.

Vial 3.—Label (penciled in longhand)—**Lycosa pallens n. sp. A. Tullgren.** Label—**Oakland Nov. 1892 E. L-g.** In this vial there are one female *L. lenta* Hentz and one female *L. miami* (?) Wallace.

Vial 4.—Label (penciled in longhand)—**Lycosa pallens n. sp. Det. A. Tullgren.** Label—**Orlando Jan. 93 E. L-g.** In this vial are two females of *L. lenta* Hentz.

Vial 5.—Label—**Lycosa pallens Tullgr. n. spec. Florida 1892-93 ♂ ♀ E. Lonnberg Rul[?] af A Tullgren.** This label is the only one in the five vials written in ink. It is written in a beautiful, regular script with the words **Lycosa pallens** much heavier and larger than the others. This vial contains one male *L. ammophila* Wallace and one female which possibly belongs to the same species.

DISTRIBUTION.—Central peninsular Florida in Orange, Osceola and Pasco counties; west coast of Florida in Pinellas and Sarasota counties.

Lycosa timuqua Wallace

1942. *Lycosa timuqua* Wallace (in part), Amer. Mus. Nov., No. 1185: 8; figs. 5, 6, 20. [♂ Holotype from Florida, Martin Co., Jensen; not the central peninsular form.]

L. angusta and *timuqua* are retained as distinct species until such time as it can be shown definitely that they intergrade or that the differences mentioned by Wallace (1942) are not of systematic importance.

DISTRIBUTION.—East coast of Florida from Brevard County southward onto the Florida Keys; northern peninsular Florida north of Orange County; Atlantic and Gulf coastal plain from South Carolina westward into Mississippi.

Lycosa riparia Hentz

Figure 6

1844. *Lycosa riparia* Hentz, Jour. Boston Soc. Nat. Hist., **4**: 389; p. xvii, ff. 13-15. (Reprint) Spiders U. S., p. 31, pl. iii, ff. 13-15.

1901. *L. albopunctata* Tullgren, Bih. Svenska Vet.Akad. Handl.,**27**(4, 1): 18; fig. 8a-b.

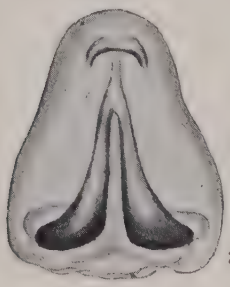
There are three vials in the collection containing specimens labeled *albopunctata,* as follows:

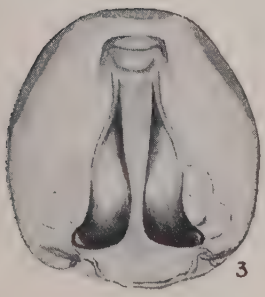
Vial 1.—Label—**Lycosa albopunctata N. Spec. Florida 1892-93 E. Lonnberg. But af A. Tullgren.** This label is in script in ink and the accompanying specimen is a medium sized adult female of the species known to American workers at present [2] as *riparia* Hentz. Its measurements agree well with those of the smaller of the two specimens cited by Tullgren (carapace 7.2 mm./5.7 mm.) There is no indication of its selection as a type specimen. Tullgren's figure 8b of the epigynum of the

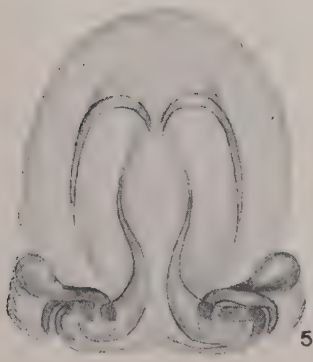
[2] It is the writer's opinion that the spider described by Hentz was not what is commonly called *riparia.* His description of both structure and habits fits what is now called *L. helluo* Walck. Dr. W. J. Gertsch has pointed out in a letter to me that *riparia* Hentz is preoccupied by *riparia* C. L. Koch, 1833; Chamberlin and Ivie (1944), in Spiders of Georgia, have resurrected Walckenaer's name *georgicola* for this species. The situation obviously needs further study.

PLATE I. Fig. 1—*Pardosa georgiae,* male palpus. Fla., Alachua Co., 16 Jan. 1949. Fig. 2—*P. georgiae,* epigynum. Ga., Floyd Co., 29 Aug. 1950. HKW 1339C. Fig. 3—*Pardosa longispinata,* epigynum. Fla., n. of Palatka, 12 June 1935, Gertsch. *P. longispinata,* male palpus. Fla., Pasco Co., 22 Mar. 1947 HKW 1244. Fig. 5—*Lycosa hentzi,* epigynum. Umschen, Fla., Tullgren Collection. Fig. 6—*Lycosa riparia,* epigynum. Fla., 1892-93 E. Lonnberg. *(Lycosa albopunctata n. sp.)*

PLATE I







smaller described specimen agrees in general outline with that of this specimen, but the figure appears to represent the epigynum of an immature specimen.

Vial 2.—Label—**L. albopunctata n. sp. AT-u.** Label—**Orlando 1892-93 E. Lonnberg.** Both labels are penciled in longhand. The specimen in this vial is a large adult female *L. riparia* Hentz, and agrees well in measurements with the large female cited by Tullgren (carapace 8.2 mm./6.0 mm.). The figure of the epigynum (8a) resembles a *Schizocosa* more than it does that of this specimen. However, I believe what appears in the drawing to be excavations in the ends of the transverse piece of the guide are intended to represent the dark portions of the ends as they occur in the specimen.

Vial 3.—Label—**L. albopunctata n. sp. AT-u.** Label—**Lake Leonore 5/9 92 E L-g.** Both labels are penciled in longhand. This vial contains two specimens, an immature of the *lenta* group, and an adult female of what is probably *L. helluo* Walck. The latter specimen is possibly one of those cited by Tullgren as *L. nidicola* Emerton.

Sosippus floridanus Simon

Figure 8

1898. *Sosippus floridanus* Simon, Ann. Soc. Entom. Belgique, **42**: 25.
1901. *L. (Pirata) Loennbergi* Tullgren, Bih. Svenska Vet.Akad. Handl., **27**(4, 1): 19; fig. 10.
L. (Pirata) transversolineata Tullgren, ibid., p. 20, fig. 11.

In the collection there are four vials containing all of the specimens cited by Tullgren under *Loennbergi* and *transversolineata*, as follows:

Vial 1.—Label—**Pirata lonnbergi n. sp. A. Tullgren.** Label—**Arcadia 12/4/93.** Both labels are penciled in longhand. This vial contains one adult female of *S. floridanus* Simon.

Vial 2.—Label—**(Pirata) Lycosa transversolineata n. sp. AT-u.** Label—**Victoria Lake County 1/9/92 E. L-g.** Both labels penciled in longhand. This vial contains an adult female of *S. floridanus* Simon with egg sac.

Vial 3.—Label—**Lycosa (Pirata) transversolineata n. sp. AT-u.** Label—**Lake Leonore 5/9/92** [?] **E. L-g.** Both labels penciled in longhand. This vial contains one adult female of *S. floridanus* Simon.

Vial 4.—Label—**Lycosa (Pirata) transversolineata AT-u.** (Reverse side of label)—**Arcadia Florida 92-93 E. Lonnberg.**

Label penciled in longhand. This vial contains a penultimate male of *S. floridanus* Simon.

Lycosa hentzi Banks

Figure 5

1904. *Lycosa hentzi* Banks, Proc. Acad. Nat. Sci., Philadelphia, **56**: 135; pl. viii, ff. 15, 16.

Included in the lot is one vial labeled **Florida Umschen [?] L. F.** containing one adult female *hentzi*. This specimen was not listed by Tullgren unless it is the "single young female" of *L. scutulata [rabida]* from Orlando.

Pirata insularis Emerton

Figure 9

1885. *Pirata insularis* Emerton, Trans. Conn. Acad. Arts Sci., **6**: 492; pl. xlviii, fig. 8.

1901. *Pardosa bilobata* Tullgren, Bih. Svenska Vet.-Akad. Handl., **27**(4, 1): 22; fig. 12.

Two adult female *Pirata insularis* are contained in one vial, label penciled in longhand—**Pardosa bilobata n. sp. A Tullgren Lake Leonore 5/9 92 E. L-g.**

Pardosa longispinata Tullgren

Figures 3, 4

1896. *Pardosa littoralis* Banks, Jour. New York Ent. Soc., **4**: 192. (*littoralis* preoccupied).

1901. *Pardosa longispinata* Tullgren, Bih. Svenska Vet.-Akad. Handl., **27**(4, 1): 23; fig. 13. [♀ from Lake Leonore, Orange Co., Florida.]

1904. *Pardosa floridana* Banks, Proc. Acad. Nat. Sci., Philadelphia, **56**: 136; pl. vii, fig. 1, pl. viii, fig. 15.

LECTOTYPE.—One adult female, label penciled in longhand—**Pardosa longispinata n. sp. AT-u Lake Leonore 92-93 E. Lonnberg.** This is the single female of *longispinata* described by Tullgren, which I now designate the lectotype.

DESCRIPTION OF LECTOTYPE.—This specimen has evidently become lighter in color than when described since the legs now appear almost white with annulations very faint, and the sternum, labium, endites and venter are almost white in color. Otherwise Tullgren's description, which follows, fits the specimen very well:

"*Cephalothorax* dark brown, clothed with short adpressed and long black upturned bristly hairs, with a white middle-band, squarish in the cephalic part as broad as the area of eyes, on the pars thoracica narrow; the area of eyes nearly black; at the margins broad white bands; the margin black. The length a little shorter than the length of tibia + patella and the breadth shorter than the length of tibia on the fourth pair of

legs.—*Eyes.* The front-row distinctly procurved, the central eyes largest and the inter-space between the central eyes about equal to their diameter and longer than the space between the lateral eyes. The distance from the lateral eyes to the margin of clypeus and to the eyes in the middle-row about thrice their diameter. The eyes of the middle-row very large and the inter-space between them longer than their diameter. The inter-space between the middle and the posterior eyes broader than the diameter of the middle-eyes.—*Sternum* small oval light brown, with long light hairs.—*Maxillae* and labium light yellow brown.—*Cheliceres* a little longer than the face, very tapering at the apex and clothed with long bristly hairs, a little narrower than the femur of first pair.—*Legs* pale brown with dark rings, the tibia of the first pair below with 2.2.2. spines; these and other spines very long.—*Abdomen* oval, brown, clothed with black and white short hairs without distinct markings; venter light grayish. The *vulva* conf. the fig. 13.

Measuresments:

length of cephalothorax	2, 5 mm.
breadth of cephalothorax	1, 8 mm.
total length	4, 2 mm.
length of 1st leg	7, 3 mm.
length of 4th leg	10 mm."

DISCUSSION.—This is the species recognized by American arachnologists as *P. floridana* Banks. In general appearance it closely resembles *P. georgiae* Chamberlin and Ivie; figures of the genitalia of the latter are included for comparison (figs. 1 and 2).

FAMILY SALTICIDAE

Phidippus variegatus (Lucas)

1833. *Salticus variegatus* Lucas, Ann. Soc. Entom. France, **2**: 478; pl. xviii, figs. 1-7.

1901. *Phidippus morsitans* (Walck.) (in part). Tullgren, Bih. Svenska Vet.-Akad. Handl., **27**(4, 1): 25. [3 ♂ ♂ not including the one described below as a new species.]

Tullgren listed four adult males of *Phidippus morsitans* from Orange County. One of the four he described; this specimen differs from the other three and is described below as a new species. The other three males are typical examples of *P. variegatus,* now probably considerably lighter in color than when preserved, but with the pattern on the dorsum of the abdomen quite evident. Florida specimens of *P. audax* resemble this species closely but can usually be distinguished by the fact that, on the dorsum of the abdomen, the paired white spots behind the large central spot are line-like whereas in *variegatus* they are round. The genitalia of *audax* and *variegatus* are distinct from each other and from the new species described below.

Two males of *variegatus* are in one vial labeled as follows: **Phidippus sp. 2** (other side of label)—**Orange County 92-93 E. L.** The other male *variegatus* is in a vial labeled: **Phidippus sp. 2** (other side of label)—**Orlando 92-93 E. L-g.**

Phidippus tullgreni n. sp.

Figures 10, 11

1901. *P. morsitans* (Walck.) (in part). Tullgren, Bih. Svenska Vet.-Akad. Handl., **27**(4, 1): 25. [The specimen described by Tullgren; labeled *Phidippus* sp. 1, Orange County, 1892-93, E. Lönnberg.]

HOLOTYPE.—Male from Orange County, Florida, 1892-93, E. Lönnberg, collector. Type deposited in the Zoologiska Institutionen, Uppsala, Sweden.

DESCRIPTION OF HOLOTYPE.—Cephalothorax 6.0 mm. long, 5.1 mm. wide, dark amber in color, posterior eyes each surrounded by black area. The ocular quadrangle appears to have been rubbed smooth. The sides of the carapace, beneath and behind the posterior lateral eyes covered with white scales which must have formed a wide white band on each side in life. Clypeus amber in color, covered with colorless hairs. Anterior row of eyes strongly recurved, a line through the center of the anterior lateral eyes passes through the upper edge of each anterior median eye. Anterior median eyes three times as large as the anterior laterals, about ⅓ the diameter of an anterior lateral eye apart; anterior lateral eyes about ⅔ their diameter from the anterior median eyes. Ocular quadrangle wider than long, wider behind than in front. Clypeus equals ⅔ diameter of an anterior lateral eye. Chelicerae irridescent, with a suggestion of the prominence so conspicuous on the prolateral surface in *P. audax*. Dorsum of the abdomen bears a large, amber-colored sclerotized plate which covers most of its surface. This plate is truncate posteriorly. Anterior margin of dorsum with a wide white band; posterior ¼ of dorsum, behind truncate dorsal plate, almost white. The dorsal sclerotized plate is marked by two pairs of muscle attachment depressions, one pair in the middle, and one pair about in the middle of the anterior half. All that remains of the anterior middle white spots described by Tullgren are a few white scales located adjacent to the posterior pair of muscle attachment depressions. A large white spot of white scales is located at each of the posterior lateral corners of the dorsal plate. Sides of the abdomen are dusky with three oblique white stripes extending caudoventrally. Venter dusky. Sternum and coxae I dark amber, coxae II-IV lighter amber. Labium and endites quite dark proximally, lightening to color of sternum distally. Femur, patella and tibia of palpi light, cymbium darker—all covered with amber covered hairs, now almost colorless. All segments legs I dark and covered ventrally with dense brush of brown hairs except the patella and proximal ends of metatarsus and tarsus, where they are white. On the distal half of femur I the terminal ends of the hairs of the brush are white. Leg II also has ventral brush, but not as dense as on Leg I and this brush is composed uniformly of brown hairs. Legs III and IV also are covered with a brown brush, but somewhat less dense than that of Leg II.

Palpal segments: femur 2.2 mm., patella 0.7 mm., tibia 0.4 mm., cymbium 1.5 mm.

	Femur	Patella	Tibia	Meta-tarsus	Tarsus	Total
I	4.2	3.1	3.5	2.9	1.4	15.1
II	3.2	2.1	2.3	2.1	1.0	10.7
III	3.1	1.8	1.9	2.2	0.9	9.9
IV	3.7	2.0	2.6	2.9	1.0	12.6

Since the specimen described above has undoubtedly become lighter in color over the years I will append Tullgren's descirption for comparison. His measurements are in the neighborhood of 0.5 mm. greater than those I make for the specimen; I have noticed this to be true also for other specimens:

"Male.—*Cephalothorax* black, with two broad white lateral bands, strewed with short hairs and having long black hairs near the small median eyes. Clypeus with long and short dark hairs.—*Eyes.* The front-row very recurved with the lateral eyes separated from the central eyes by ⅔ their diameter. The central eyes separated from the margin of clypeus by ⅔ their diameter.—*Legs* 1.4.2.3; the patellae always shorter than the tibiae. On the sides of patella of first pair large brushes of white hairs are found. On the front-side of the other patellae and on the base of the tarsi and the metatarsi white hairs.—*Abdomen* black; at the middle are two small white spots; behind these are two larger, somewhat oblique, white spots and lower down two minute white dots; around the base a broad white band and on the sides, between the ends of this and the middle spots an oblique white spot. The venter perfectly black.

Measuresments:

length of cephalothorax ..... 6, 5 mm.
breadth of cephalothorax ..... 5, 5 mm.
total length ..... 13, 0 mm.
length of 1st leg ..... 16, 0 mm.
length of 4th leg ..... 13, 0 mm."

DIAGNOSIS.—Of the spiders in the genus *Phidippus* that are found in Florida, *P. tullgreni* resembles in appearance most closely *P. audax* and *P. variegatus*. From these two it can be separated easily by reference to

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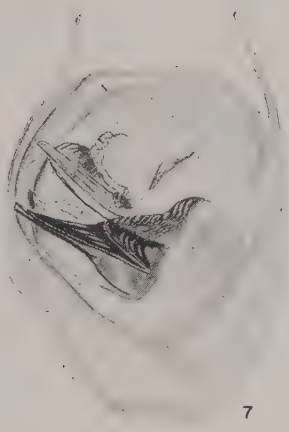
PLATE II. Fig. 7—*Lycosa angusta*, male palpus. Lectotype. Fla., Orange Co., Orlando, 1892-93, E. Lonnberg. Fig. 8—*Sosippus floridanus*, epigynum. Fla., Lake Leonore, 9 May 1892 E. Lonnberg. *(Lycosa (Pirata) transversolineata* n. sp.). Fig. 9—*Pirata insularis*, epigynum. Fla., Lake Leonore, 9 May 1892. E. Lonnberg. *(Pardosa bilobata.)* Fig. 10—*Phidippus tullgreni*, n. sp. Tibial apophysis. Holotype. Fla., Orange Co., 1892-93, E. Lonnberg. Fig. 11—*P. tullgreni*, n. sp. male palpus. Holotype. Fig. 12—*Phidippus cardinalis*, epigynum. Fla., Oakland, Nov. 92, E. Lonnberg. *(Phidippus oaklandensis.)*. Fig. 13—*Phidippus clarus*, epigynum. Fla., Orange Co., Clarcona, Nov. 92. E. Lonnberg. *(Phidippus olivaceus.)*.

PLATE II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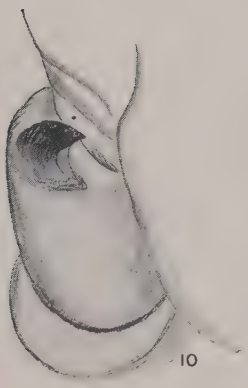
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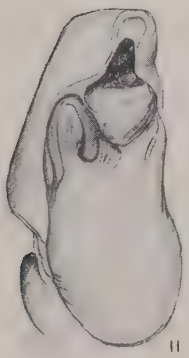
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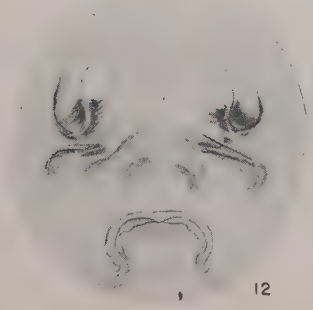
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the spatulate shape of the embolus. The range of variation in color pattern and size is so great in *variegatus* that the only safe procedure in the identification of it and related species is to rely upon the genitalia. The palpus of *tullgreni* closely resembles that figured for *P. otiosus* by the Peckhams (1909).[3]

Phidippus clarus Keyserling

Figure 13

1884. *P. clarus* Keyserling, Verh. zool. bot. Ges. Wien, **34**: 497; pl. xiii, fig. 7. ♀

1901. *P. bilineatus* Tullgren, Bih. Svenska Vet.-Akad. Handl., **27**(4, 1): 26; fig. 15. [♀—Orange Co., Florida.]

P. clarconensis Tullgren, ibid., p. 28, fig. 17. [♀—Clarcona, Orange Co., Florida.]

There are two vials in the collection each of which contains a female *P. clarus* with labels penciled in longhand as follows:

Vial 1.—Label—**Phidippus bilineatus Tullg.** Label—**Orange County 92-93 E. L-g.** This specimen is much lighter in color than when described. The exoskeleton has become somewhat transparent and its covering of hairs, etc., has lost most of its color. The carapace is now light amber, with black spots close to the eyes visible through the exoskeleton. The dorsum of the abdomen is light yellow with lateral margins dusky and a central dusky area shaped like an arrow-head pointing posteriorly. The front margin of the dorsum has a light stripe which extends about half way back along the sides beneath the lateral dusky stripes. The legs are a little darker than the abdomen, but lighter than the carapace, with the distal ends of most segments dusky. The palpi are a little lighter than the legs; the chelicerae are dark amber in color, the labium and endites light amber, white distally. The sternum is just a shade off white, the coxae light amber, almost white. The venter has a wide median stripe, almost white; the sides are faintly dusky. The internal, sclerotized portions of the epigynum are clearly visible through the surface (figure 13); the epigynum closely resembles Tullgren's figure 15 of *bilineatus*.

Vial 2.—Label—**Phidippus olivaceus Tullg.** Label—**Florida Orange County Clarcona Nov. 92 J** [?] **Lonnberg.** This is evidently the specimen described by Tullgren as *P. clarconensis*. It is somewhat lighter than when described, resembling the other specimen of *clarus* except for a darker carapace, lighter dorsum,

[3] Revision of the Attidae of North America. 1909. Trans. Wisconsin Acad., **16**(1-5): pl. 34, figs. 6 c, d.

and darker longitudinal bands on the venter—the ocular quadrangle is quite dark, the longitudinal dark bands on the dorsum are only faintly indicated. The epigynum (figure 13) no longer resembles that figured by Tullgren since the internal sclerotized portions are visible and form the most conspicuous part of it.

Phidippus cardinalis (Hentz)

Figure 12

1844. *Attus cardinalis* Hentz, Jour. Boston Soc. Nat. Hist., **4**: 386; pl. 7, fig. 9. ♂. (Reprint) Spider U. S. 1875, p. 51.

1901. *Phidippus oaklandensis* Tullgren, Bih. Svenska Vet.-Akad. Handl., **27**(4, 1): 27; fig. 16. ♀.

A single female with labels penciled in longhand—**Phidippus oaklandensis Tullg.** and **Oakland Nov. 92 E. L-g.**—is included in the shipment. This specimen closely resembles the two females of *clarus* described above. It differs from them in several important details. The epigynum is shorter and broader than in *clarus* with the openings farther apart, and the venter is immaculate. Also, the dorsum of the abdomen bears two dark longitudinal stripes that extend anteriorly almost to the front end of the abdomen. The front end of the dorsum is almost white, no basal stripe being evident; laterally such a stripe occurs. In the posterior third of the longitudinal dark bands of the dorsum occur two pairs of distinct white spots. Part of the internal structure of the epigynum is visible and is noticeably wider than in *clarus*. The epigynum does not resemble Tullgren's figure very closely. The carapace and legs appear to be marked identically as in *clarus*.

Plexippus paykulli (Audouin)

1827. *Attus paykulli* Audouin, in Savigny, Descr. de l'Egypte, **22**: 172.

1901. *Menemerus paykulli* (Audouin). Tullgren, Bih. Svenska Vet.-Akad. Handl., **27**(4, 1): 29.

One female is included, labels penciled in longhand as follows: **Menemerus paykulli ? ?** and **Orange County Florida 1892-93 E. Lonnberg.**

ACKNOWLEDGMENTS

I am indebted to Dr. W. J. Gertsch of the American Museum of Natural History, New York, for reading and criticizing the manuscript. Dr. Gertsch has also examined the specimens in the collection and we are in agreement on their identity. I wish also to express my appreciation to Miss Esther Coogle, Staff Artist for the Biology Department and the College of Agriculture. All of the drawings for this paper were made by her.

A REMARKABLE NEW BELOSTOMATID (HEMIPTERA) FROM FLORIDA AND GEORGIA

ROLAND F. HUSSEY, Florida Southern College, Lakeland, and
JON L. HERRING, University of Florida, Gainesville

The fourteen species of *Abedus* known heretofore are found in the southwestern United States and Mexico, with one of them ranging as far north as Utah and another one south to Panama. The new species here described is a notable exception, as it is known thus far only from the northern half of Florida and from southeastern Georgia. It appears to be quite uncommon, and only about a dozen specimens have been taken in several years' collecting. Most of these were found by the junior author in north-central Florida in shallow "flatwoods" ponds which may disappear during the dry season. The senior author has taken a single specimen from water hyacinths at the edge of the permanent stream forming the outlet from Kissengen Springs near Bartow in Polk County; and one was collected by J. E. Burgess, Jr., from a shallow cypress swamp between Lakeland and Dade City in northern Polk County.

This species, less than 15 mm. long, is the smallest known Belostomatid from North America. It is a pygmy among giants in its own genus, where the other species are from 23 to 35 mm. in length. It is less broadly rounded behind than most species of *Abedus,* approaching in this respect most nearly the very much larger *Abedus usingeri* as figured by De Carlo (1948, Pl. III, fig. 17). On superficial examination it strongly suggests a small pale *Belostoma testaceum* (Leidy), and most of our specimens have a pale median vitta on the dorsum such as occasionally (though rarely) occurs in that species, and in other small species of *Belostoma.* The smallest *B. testaceum* among numerous specimens at hand is 16 mm. long, but Blatchley (1926, p. 1048) gives the length of this species as 14 to 18 mm. The authors suspect that he—and possibly others—may have failed to distinguish it from the new *Abedus.* This surmise cannot be verified, however, as the authors are informed by Dr. George E. Gould that there are no specimens under the name *Belostoma testaceum* in the Blatchley collection now at Purdue University.

For a time it was believed that this species might possibly represent a new genus annectant between *Belostoma* and *Abedus,* to be distinguished from *Abedus* primarily by the form of the second ventral segment. In most species of *Abedus,* including

those then at hand, this sclerite on each side is triangular with its inner angle closed and situated laterad of the hind coxa, a condition found also in the author's specimens of *Benacus*, *Lethocerus* and *Kirkaldyia*. In *Belostoma* and in the new species the posterior margin of this sclerite passes well behind the coxa so that the triangle is open at its inner apex. But examination of a specimen of *Abedus ovatus* (Say), kindly loaned by Dr. R. L. Usinger, shows that in this species (the genotype of *Abedus*) the second segment is formed as in *Belostoma*. Dr. José A. De Carlo writes (personal correspondence) that this is true also in *A. hungerfordi* De Carlo and *A. usingeri* De Carlo. The form of the second ventral segment, which the authors believe has not been used before as a character, is therefore of no more than specific value in the genus *Abedus*.

In spite of its small size, its small eyes, and its general habitus, this species cannot be placed in *Belostoma* because of its narrow membrane, its wide interocular space, its antennal structure, and its metaxyphus tumid behind and lightly carinate in front. These characters all align it with *Abedus*, but it does not fit into any of the subgenera as delimited by Montandon (1903) nor in any of the new subgenera whose characterizations Dr. De Carlo has very graciously sent the writers in advance of publication of his forthcoming "Nueva agrupación de las especies del género *Abedus* Stål." From the first it was recognized that this species, if not generically distinct from *Abedus*, at least necessitates a new subgenus, and Dr. De Carlo concurs in this opinion after examining specimens sent to him.

ABEDUS subgenus MICROABEDUS, n. subg.

Antennae 4-segmented, the segments all discrete, the third one with a short dorso-lateral prolongation. Eyes oblique, not at all globose, their antero-median margins subparallel or most lightly diverging in front. Silky pilosity confined to the lateral plates, not encroaching on the ventral lobule, absent from the second segment, extending onto the connexivum on the third segment only. Metasternum moderately convex posteriorly, becoming lightly carinate in front. Only small species known. Subgenotype: *Abedus (Microabedus) cantralli*, n. sp.

Abedus (Microabedus) cantralli, n. sp.

Holotype male:[1] Length 13.5, humeral width 4.5, maximum width across apical third of clavus 6.5.

[1] All measurements are expressed in millimeters.

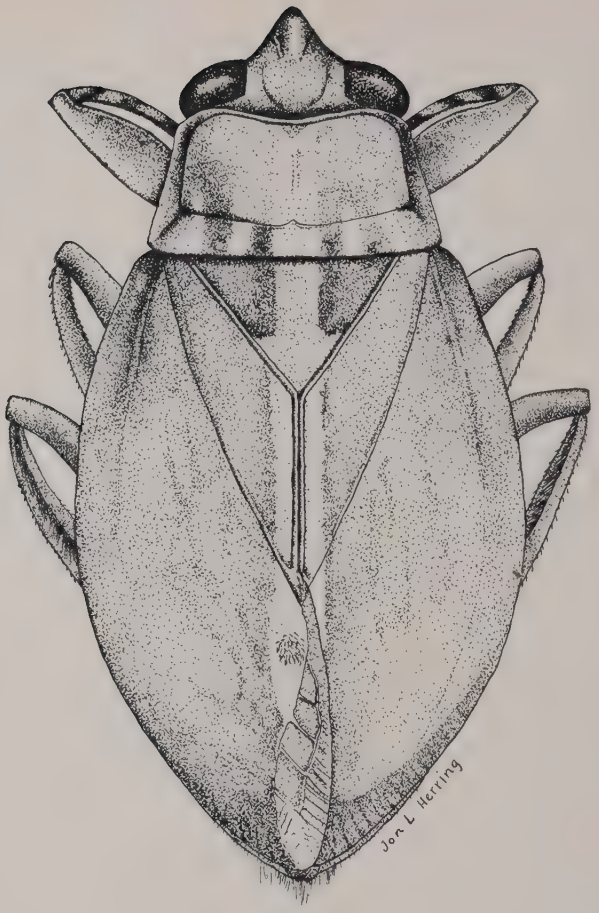

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Figure 1. Dorsal view of *Abedus (Microabedus) cantralli*, n. sp. Drawn from a male collected at Miller's Pond on August 6, 1946.
Figure 2. Lateral view of the antenna.

Head triangular, moderately inclined; its length (measured in profile along the long axis of the head, not as projected on the long axis of the body) from the posterior margin of the eye to the tip of the tylus 2.1, of which 1.1 is pre-ocular length; maximum width including the eyes 3.3, minimum interocular width 1.7, the inner margins of the eyes scarcely divergent anteriorly, meeting the posterior margins in an obtuse angle about midway of the length of the eye; eyes 0.9 long by 0.8 wide, oblique, depressed well below the level of the vertex which is rather flat on its disk; tylus narrow, very lightly prominent above; bucculae subtriangular, their antero-ventral angles rounded; first and second rostral segments each 0.75 long. Antennal segments I to IV respectively 0.14, 0.09, 0.08 and 0.23 in length, the segments formed as shown in Fig. 2, the last three segments minutely pubescent on the outer side especially; first segment 0.09, fourth 0.13 in thickness. Head somewhat tumid below, with a number of small spinules at the middle of the postero-ventral face; depth of the head 1.20 measured perpendicularly to the plane of the vertex.

Pronotum trapezoidal, its length 2.0 on the median line and 2.2 behind the inner margins of the eyes, its width 3.2 in front and 4.5 at the humeral angles, the anterior margin broadly sinuate between the eyes, the posterior margin straight; antero-lateral angles distinct, obtuse, including about 125°; lateral margins very nearly straight, the sinuation scarcely evident, narrowly (0.21) explanate and very lightly reflexed, a linear impression marking the inner border of the explanate margin toward the front. Transverse pronotal suture most lightly impressed, ending in a distinct triangular fovea at each side, the anterior lobe remotely and most obsoletely punctate, its median length 2.3 (in some paratypes nearly 3.0) times the length of the posterior lobe which is much more densely and distinctly punctate. Scutellum 2.75 wide by 2.2 long, with a broad sharply defined transverse sulcus entirely across its base. Claval commissure 2.38 in length to end of the claval vein, 3.13 to end of the claval suture, the latter paralleled at each side by a distinct percurrent vein, radial vein of the corium also distinct and percurrent, the other veins feeble and irregular, apparently not always in agreement even on the two hemelytra of a single individual. Membrane with about five closed sub-rectangular cells in the basal row and with numerous much narrower open cells in the apical row, the longest cells of one row subequal in length to the longest cells of the other; maximum width of the membrane 1.6; the membrane very narrowly extended forward along the anal margin of the corium to the apex of the clavus, and almost as far along the costal margin, these anterior extensions without veins or cells.

Scutellum, clavus and corium quite closely, most finely punctate, between the punctures (in fresh specimens) with extremely short subsquamiform setulae, these quite sparse but becoming more numerous on the veins posteriorly and forming a fairly thick group on the extreme tip of the clavus, replaced by longer hairs on the apex of the corium and on the membrane; inner apical angle of the corium with the usual semi-elliptical area, 0.4 long, of golden pubescence.

Front legs: femur 4.1 long, its greatest width 1.25; tibia 2.8 long; tarsal segments 0.29 and 0.40 respectively along the outer side, the single claw 0.40 long, straight for about ⅘ its length, then curved inward.

Middle legs: femur 3.6 long on the anterior margin and 0.9 wide, flat on its inner surface with the pubescence forming a very shallow longitudinal groove much less distinct than that on the fore femur; maximum length of tibia 3.0, its width 0.4, sides subparallel for most of its length, the apex oblique on the outer half; first tarsal segment barely surpassing the apical spines of the tibia, second and third segments respectively 0.41 and 0.69 long, the claws 0.50, straight on their inner margins for more than half their length. Hind legs: femur 4.4 long and 0.8 wide; tibia 4.1 long and 0.5 wide, the apex oblique on the outer half, the tibia flattened and thinly triquetrous; first tarsal segment minute, second and third respectively 0.6 and 0.85, the claws 0.53 long.

Median carina of the prosternum about half as high as it is long, obtusely angulate-rounded as seen from the side, bearing numerous spinules especially on its anterior third. Metasternal xyphus tumidly swollen behind and lightly carinate in front between the middle coxae, lightly linearly impressed within the lateral margin, the apex depressed, acute. Median lengths of ventral segments IV to VI respectively 0.75, 1.20, 1.25. Silky pubescence confined to the lateral plates, not invading the median lobule of the venter, absent on the second segment, covering the connexivum below on the third segment only, continued backward at each side of the genital operculum for about two-thirds of its length. Retractile caudal setae very long and narrow, measuring 2.25 from the spiracle to the tip, 0.25 wide near the base and 0.35 at the widest part on the apical third, the tip bluntly pointed.

Color light testaceous, commonly with a distinct percurrent pale median vitta about 0.8 wide extending from the tylus to the tip of the clavus, this vitta somewhat less evident on the anterior pronotal lobe and the base of the scutellum; posterior lobe of the pronotum paler, with two dark marks on each side the same color as the anterior lobe, these marks sometimes broken up into two or three closely approximated longitudinal lines. Head next the eyes and basal part of the scutellum darker. Corium irregularly marked with fuscous, especially on the inner part where the markings tend to coalesce into ill-defined longitudinal streaks which may be broad or narrow and may be dissimilar on the right and left hemelytra. Last three connexival segments above and below with a small fuscous spot at the middle, the upper side also with a smaller pre-apical spot. Membrane brown.

Beneath fusco-testaceous, the pleura with an indistinct broad dark band extending lengthwise below the upper margin, the venter with blackish areas which tend to join in a broad longitudinal band on each side of the middle line; venter moderately closely covered with minute pale sub-squamiform setulae on the entire median lobule, these becoming longer on the genital operculum. Middle and hind coxae each with a small blackish basal spot on the outer side; femora (especially the posterior pairs) faintly marmorate with fuscous, all the tibiae obsoletely triannulate with brown, the pre-apical annulus sometimes scarcely visible.

In darker specimens, such as the two from Polk County, the dorsal coloration is more uniform and the median pale vitta

is obsolete, and the posterior pairs of femora are very faintly, incompletely biannulate with fuscous before the tips.

HOLOTYPE: ♂, Miller's Pond, 4.2 miles east of Science Hall, Gainesville, Alachua County, Florida, Aug. 8, 1946 (J. L. Herring), in the Museum of Zoology of the University of Michigan.

ALLOTYE: ♀ Miller's Pond, Aug. 8, 1946, same data as for holotype.

PARATYPES: Miller's Pond, Aug. 6, 1946 (J. L. Herring, 1♂, 1♀; Aug. 8, 1946 (J. L. Herring, 1♂, 2♀♀. Biven's Arm of Payne's Prairie, Alachua County, Florida, Apr. 5, 1937 (L. Berner), 1♂. Roadside ditch, four miles north of Gainesville, Alachua County, Florida, May 7, 1947 (J. L. Herring), 1♂. Flatwoods pond, four and one-half miles southeast of Bostwick, Putnam County, Florida, Aug. 24, 1948 (J. L. Herring), 1♂. Cypress swamp, eleven miles north of Lakeland, Polk County, Florida, Jan. 28, 1950 (J. E. Burgess, Jr.), in Burgess' collection, 1♂. Stream below Kissengen Springs near Bartow, Polk County, Florida, Oct. 28, 1948 (R. F. Hussey), 1♂. Roadside ditch, eighteen and one-half miles northeast of Jesup, Liberty County, Georgia, Apr. 19, 1947 (J. L. Herring), 1♀.

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De Carlo, Jose A. 1948. Revision del Genero *Abedus* Stal. Comun. Museo Arg. Ciencias Nat. No. 5.

MINUTES OF THE THIRTY-SECOND ANNUAL MEETING OF THE FLORIDA ENTOMOLOGICAL SOCIETY

The thirty-second annual meeting of the Florida Entomological Society was held in Tampa at the Tampa Terrace Hotel from December 13 - 17. The meetings were held in conjunction with the annual meetings of the Entomological Society of America and the American Association of Economic Entomologists. In view of the joint nature of the sessions, the Florida society dispensed with paper reading sessions and confined its program to the business meeting.

The business meeting was called to order by Mr. M. C. Van Horn, president of the society, at 1:15 P. M. in room 212 of the Tampa Terrace Hotel. It was moved by Dr. J. T. Griffiths

that the minutes of the 1948 meetings be dispensed with as they had been published in Volume 32, No. 1, of the FLORIDA ENTOMOLOGIST. The motion was seconded by Dr. Kelsheimer and passed by the members.

President Van Horn then called on Mr. Mulrennan, vice-president, for a report. Mr. Mulrennan pointed out that his activities as vice-president were rather limited and he thanked the members for electing him to his office. Mr. Van Horn then called on the secretary for a report. There were no items to be called to the attention of the society. This was followed by a request that the editor of the FLORIDA ENTOMOLOGIST, Dr. H. K. Wallace, report. Dr. Wallace made no comments. Mr. Dekle, business manager, had nothing to report.

As a next order of business, Mr. Van Horn called on the membership committee for a report. Mr. Dekle, chairman of the committee, submitted the following names for consideration by the society: For election to membership from associate membership—J. C. Alden, R. F. Allen, Major F. S. Blanton, James M. Coarsey, K. Coleman, George Cooper, C. J. Dumas, F. E. Fisher, H. G. Ford, A. N. Fox, Irving Fox, G. H. Gilbert, Tom Hill, A. E. Holland, Max Isbill, P. E. Kaspar, C. D. Kime, Jr., L. C. Kuitert, Hamilton Laudani, W. S. Lee, D. B. Lieux, W. C. McDuffie, Harry Mayfield, C. M. Meadows, F. A. Morton, Joe Nicholson, Theodore Oser, James Sewell, W. V. Shock, R. P. Tomasello, S. H. Walkup, Phil Westgate, J. F. White, E. H. Wilson. For associate membership—J. F. Aycock, C. C. Ballentine, J. E. Bussart, R. C. Colter, C. J. D'Angio, W. P. Dean, R. F. Hussey, G. H. Lucas, A. S. Mills, E. T. Nielsen, S. B. Parnell, C. V. Reichart, C. F. Rollins, G. D. Sloan, W. N. Stoner, R. B. Trueman, F. N. Turner, R. E. Williams. For student membership—J. E. Burgess, G. W. Griffith, E. H. Michelson, H. G. Parrish, Grace R. Phillips, T. G. Stewart.

It was moved by Dr. Wallace that the persons whose names were submitted be accepted for membership in the society. The motion was seconded by Dr. Bellamy and passed by the society.

The report of the auditing committee was submitted by Mr. W. Hunter at which time he recommended that no records be kept by the business manager except those of the current year. Dr. Wilson moved that the recommendation be accepted and this was seconded by Dr. Kuitert. The motion was then amended by Dr. Bellamy to state that the records be kept for purposes of auditing, but that old records be saved but not considered

Dr. Kuitert then withdrew his second. Dr. Wilson re-worded his motion to the effect that records of business transactions be kept by the business manager in accordance with good accounting practices. Mr. McClanahan seconded this motion and it was passed by the society.

Dr. Wallace moved that the report of the auditing committee be accepted. The motion was seconded by Dr. Kuitert and passed by the society.

Mr. Van Horn called for old business. There was none. He then asked for new business. Dr. Wilson proposed that the time of year when the annual meeting would be held be referred to the executive committee for action.

Dr. Berner reported on the plans for the Everglades Field Trip being sponsored by the Florida Entomological Society. The trip was designed to show visiting entomologists, who were attending the meetings of the national organizations, some of the ecological areas in southern Florida.

Mr. Hopkins reported on his plans for a booth in the lobby of the Tampa Terrace Hotel where a display of pertinent material about the Florida Entomological Society would be presented.

Mr. Van Horn then called for a report of the nominating committee. Dr. Tissot, chairman of the committee, submitted the following names for office:

President—J. M. Mulrennan
Vice-President—W. G. Bruce
Secretary—Milledge Murphey
Business Manager-Treasurer—L. C. Kuitert
Editor—Lewis Berner
Associate Editor—H. K. Wallace
Executive Committee (two years)—J. P. Toffaletti

Dr. Kelsheimer moved that the society accept the nominees by unanimous ballot. The motion was seconded by Mr. W. L. Thompson and passed by the society.

Mr. Van Horn then turned the chair over to the incoming president, Mr. Mulrennan, who thanked the society for the honor that had been bestowed on him and stated that he will do everything in his power to see that the society progresses as it has in the past.

(To Be Continued)

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- Cucurbit Insects
- Wireworms
- Hornworms
- Grubs
- Thrips
- Pumpkin Bugs
- Strawberry Weevil
- Tarnished Plant Bug
- Spittle Bug
- Pameras
- Strawberry Crown Borer

CHLORDANE is a gradually volatile chemical under outdoor growing conditions. Approximately three weeks following application of insecticides containing CHLORDANE no detectable toxic residue is found on treated crops.

Technical Chlordane is formulated into emulsifiable concentrates, wettable powders, and dusts by leading insecticide manufacturers.

Write for technical bulletins and data.

Julius **HYMAN** *& Company**

DENVER, COLORADO

*Manufacturers of OCTA-KLOR
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COPPER-A COMPOUND
A safer fungicide for copper-sensitive plants.

COTTON DUSTS
BHC, DDT and sulfur combined, or Toxaphene sulfur for all-in-one control of cotton insects.

DEENATE* DDT
Insecticide in five formulations.

FERMATE*
Organic fungicide, ferric dimethyl dithiocarbamate, adapted for use as preventive for diseases on fruits, tobacco, ornamentals and certain vegetables.

KRENITE*
Water-soluble dinitro spray, both insecticide and fungicide.

LEXONE* 10-GW
BHC wettable powder, but usable as dust.

MARLATE* 50 INSECTICIDE
Methoxychlor insecticide for fruits, vegetables and livestock—particularly dairy.

PARZATE* FUNGICIDE
Organic fungicide based on zinc ethylenebisdithiocarbamate for control of principal diseases on potatoes and certain other vegetable crops.

PARZATE* LIQUID
A fungicide based on disodium ethylenebisdithiocarbamate.

SULFORON* X
Micro-fine wettable sulfur fungicide.

ZERLATE*
Organic fungicide based on zinc dimethldithiocarbamate, compatible with most insecticides.

WEED KILLERS

AMMATE*
Ammonium sulfamate, non-selective weed killer for control of hard-to-kill woody weeds and brush.

Du Pont 83% Sodium 2,4-D Weed Killer
Sodium salt of 2,4-D acid for control of many broad-leaf plants, selectively.

Du Pont 2,4-D 65% Amine Weed Killer
Contains 2,4-D as triethanolamine salt, formulated for low gallonage applications.

Du Pont 2,4-D 74% Amine Weed Killer
Contains 2,4-D as triesopropanolamine salt, formulated for low gallonage applications.

Du Pont 2,4-D 46% Ester Weed Killer
An oily, liquid form of 2,4-D containing 46% isoproyl ester.

Du Pont 90% Sodium TCA Weed Killer
A dry powder containing 90% Sodium trichloroacetate.

OTHER DU PONT PEST CONTROL PRODUCTS

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Commercial use of THIOPHOS Insecticides in 1948 and 1949 confirmed the outstanding results obtained experimentally in 1947.

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BREWSTER, FLORIDA

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"1068"

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★ MOLE CRICKETS
★ ROACHES
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★ WIREWORMS

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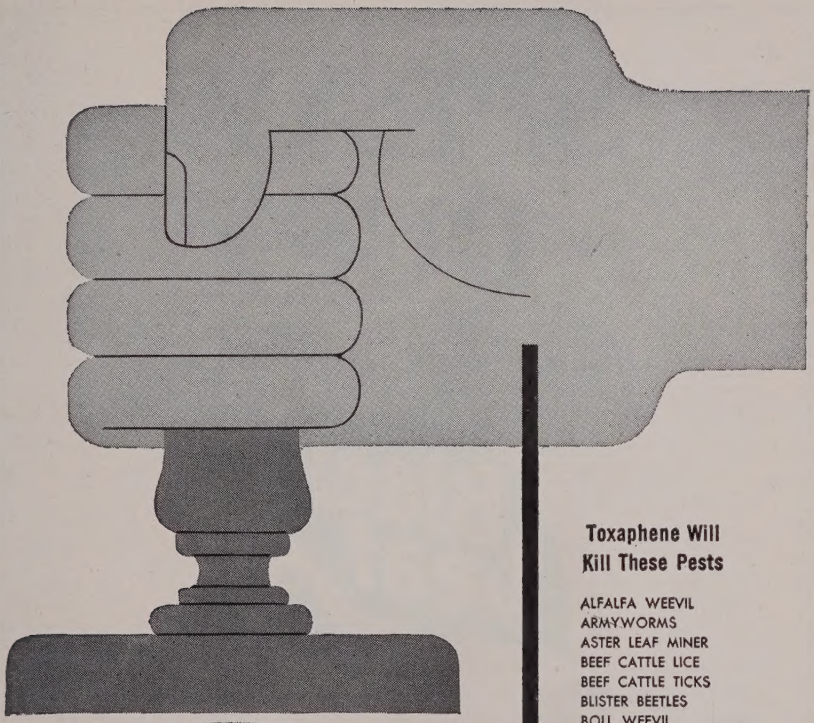

APPROVED

toxaphene

A summary of current U. S. federal or state recommendations together with technical data on toxaphene (chlorinated camphene 67-69% C1) is available on request from:

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